General

Guideline Title

ACR Appropriateness Criteria® chronic dyspnea — suspected pulmonary origin.

Bibliographic Source(s)

Dyer DS, Mohammed TL, Kirsch J, Amorosa JK, Brown K, Chung JH, Ginsburg ME, Heitkamp DE, Kanne JP, Kazerooni EA, Ketai LH, Parker JA, Ravenel JG, Saleh AG, Shah RD, Expert Panel on Thoracic Imaging. ACR Appropriateness CriteriaÂ® chronic dyspnea - suspected pulmonary origin. [online publication]. Reston (VA): American College of Radiology (ACR); 2012. 5 p. [68 references]

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Dyer DS, Khan AR, Mohammed TL, Amorosa JK, Batra PV, Gurney JW, Jeudy J, Kaiser L, MacMahon H, Raoof S, Vydareny KH, Expert Panel on Thoracic Imaging. ACR Appropriateness Criteria® chronic dyspnea - suspected pulmonary origin. [online publication]. Reston (VA): American College of Radiology (ACR); 2009. 4 p.

Recommendations

Major Recommendations

ACR Appropriateness Criteria®

Clinical Condition: Chronic Dyspnea—Suspected Pulmonary Origin

Variant 1: Any age.

Radiologic Procedure	Rating	Comments	RRL*
X-ray chest	9	A negative chest radiograph does not exclude diffuse disease.	
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Variant 2: Any age, nonrevealing or nondiagnostic clinical, standard radiography, and laboratory studies.

Radiologic Procedure	Rating	Comments	RRL*
CT chest without contrast	9	In the setting of chronic dyspnea, the most appropriate imaging study is a thin section high resolution chest CT with prone imaging when appropriate. In patients with obstructive or mixed PFTs, the inclusion of expiratory imaging is important to evaluate air trapping and possible tracheobronchomalacia.	
CT chest with contrast	5	Usually not indicated unless suspect mediastinal or hilar adenopathy or fibrosing mediastinitis as cause for dyspnea. If a patient has dyspnea not clearly of pulmonary origin, other entities such as chronic or acute pulmonary embolism may need to be excluded. In that setting, a chest CTA is appropriate. See the NGC summary ACR Appropriateness Criteria® acute chest pain — suspected pulmonary embolism.	
MRI chest without contrast	2	May be useful in characterizing pleural and chest wall masses, but its use in diffuse lung disease is currently limited to research.	O
MRI chest without and with contrast	2	May be useful in characterizing pleural and chest wall masses, but its use in diffuse lung disease is currently limited to research.	O
CT chest without and with contrast	1		
FDG-PET/CT chest	1	May be useful in characterizing pleural and chest wall masses, but its use in diffuse lung disease is currently limited to research.	
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the table are listed at the end of the "Major Recommendations" field.

Summary of Literature Review

Introduction/Background

Dyspnea is generally defined as a subjective experience of breathing discomfort. It is often described as breathlessness or shortness of breath. Functional brain imaging studies have shown that dyspnea is associated with activation of the limbic system, especially the insular area. The cause for dyspnea is usually cardiopulmonary disease. Common cardiovascular causes are myocardial infarction and congestive heart failure. Common pulmonary causes include asthma, emphysema, pneumothorax, pulmonary embolism, upper airway obstruction, and interstitial lung disease. The clinical signs and symptoms often determine whether the cause is cardiac or pulmonary. The distinction between cardiac and pulmonary causes, however, is not always obvious. Furthermore, the etiology has been reported to be multifactorial in up to one-third of patients. Certain laboratory and ancillary tests are helpful such as hemoglobin, brain natriuretic peptide (BNP) test, pro-BNP, pulse oximetry, 6-minute walk test, and pulmonary function tests (PFTs). It is important to distinguish whether the dyspnea is acute (lasting a few minutes to a few hours) or chronic (duration >1 month).

Two important causes for acute dyspnea, pulmonary embolism and congestive heart failure, are not included in this section as they are reviewed in other ACR Appropriateness Criteria® topics. Another significant cause of dyspnea and disability in patients with chronic lung disease is pulmonary hypertension, which is addressed in another ACR Appropriateness Criteria® topic dedicated to the condition. This document addresses chronic

dyspnea of pulmonary origin, particularly chronic obstructive pulmonary disease and interstitial lung disease.

Chest Radiography

It is recognized that the decision-making process in the individual patient is affected by factors other than just the presence or absence of dyspnea, including the severity of dyspnea and the presence or absence of other symptoms and other risk factors (cardiovascular, pulmonary, and neoplastic diseases). In clinical practice, chest radiography is usually performed as part of the initial evaluation of dyspnea. Two studies suggest that the chest radiograph adds enough additional useful information to recommend its routine use in patients with chronic and acute dyspnea. A review study stated that the most useful methods for evaluating dyspnea are the electrocardiogram (ECG) and chest radiograph. In another study, chest radiographs were helpful in making a diagnosis in 66% of the hospitalized patients admitted for other reasons and referred to respiratory physicians for breathlessness. A retrospective review of the value of chest radiographs in chronic obstructive pulmonary disease (COPD) found that radiographs detected treatable disease in 14% of cases and changed management in 84% of cases. In a review of evidence-based approaches, a group of researchers recommended chest radiography in the initial assessment of patients with acute exacerbation of COPD.

Computed Tomography

High-resolution computed tomography (HRCT) is considered the best imaging tool for assessing diffuse lung disease. It is particularly appropriate in patients when the results of the clinical, radiographic, and laboratory studies are either nonrevealing or nondiagnostic. Many diseases, including bronchiectasis, sarcoidosis, emphysema, pneumoconiosis, idiopathic pulmonary fibrosis, Langerhans cell histiocytosis, hypersensitivity pneumonitis, bronchiolitis obliterans, lipoid pneumonia, drug toxicity, and lymphangitic cancer, have features characteristic enough to enable experienced radiologists to make a confident, probable, or limited differential diagnosis in most cases. Biopsy and additional diagnostic testing are often unnecessary. HRCT may reveal an abnormality even when the chest radiograph is normal. There is a good correlation between the extent of disease on HRCT and the level of dyspnea in patients. HRCT is also a sensitive indicator of disease progression and can be used as an outcome measure in therapeutic trials.

HRCT is the most sensitive modality for diagnosing early emphysema in smokers with dyspnea. The severity of dyspnea and air trapping on CT correlates with PFTs. A group of researchers found HRCT to be more sensitive than PFTs for diagnosing emphysema. HRCT provides unique phenotypic information in COPD and can predict health status.

Expiratory HRCT is a powerful adjunct to inspiratory HRCT in the diagnosis of diffuse lung disease. In certain interstitial lung diseases, such as chronic hypersensitivity pneumonitis, expiratory imaging can show characteristic lobular air trapping. Expiratory scans are useful in the differentiation of causes of inhomogeneous lung attenuation. In COPD, expiratory CT reflects airflow limitation and correlates well with levels of dyspnea. Dynamic contiguous expiratory CT improves the recognition and diagnosis of tracheobronchomalacia.

Inspiratory high resolution CT images are typically 1 to 2 mm in thickness, done in the supine and, if necessary, prone positions. Contiguous or noncontiguous thin section expiratory imaging is added in patients with known or suspected air flow limitation. CT scans with a slice thickness of >5 mm are NOT adequate to demonstrate fine detail in the lungs.

Intravenous contrast is rarely needed in the evaluation of chronic dyspnea. It is useful, however, in diagnosing fibrosing mediastinitis in which the obstruction of vital structures is elegantly demonstrated.

It is important to recognize that radiology and pathology have complementary roles in the evaluation of diffuse lung disease. CT can help guide surgeons to optimal biopsy sites. Chest radiography and CT capture the entire lung as an in vivo gross specimen" and convey architectural details, multifocal abnormalities, and overall distribution of findings. It is crucial for the pathologist to interpret lung histology in diffuse lung disease with an appreciation of information provided by radiologic studies.

Magnetic Resonance Imaging and Positron Emission Tomography

Magnetic resonance imaging (MRI) has been investigated as an alternative imaging tool to CT due to its lack of ionizing radiation. One study found 3T MRI to be useful in differentiating inflammatory and fibrous lesions in 26 patients with usual interstitial pneumonia and nonspecific interstitial pneumonia. Hyperpolarized helium 3 MRI appears to be a safe and sensitive tool in the quantitative evaluation of COPD. It also seems to be useful in the diagnosis of pneumonia and bronchial abnormalities in immunocompromised patients.

Fluorine-18-2-fluoro-2-deoxy-D-glucose positron emission tomography (FDG-PET) has been shown to demonstrate disease activity in diffuse lung disease, sarcoidosis, and drug toxicity. A group of authors found differences in metabolic activity depending on morphology, with higher FDG metabolism in areas of reticulation and honeycombing than in areas of ground glass.

Both MRI and PET have been shown to be useful in evaluation of chest wall masses and pleural disease. Otherwise, the use of MRI and PET still seems to be limited to research, and investigators acknowledge the superiority of CT in diffuse lung disease.

Summary

- Chest radiography is indicated when dyspnea is chronic or severe. It has been shown to change management in up to 84% of cases.
- HRCT is the best imaging tool for assessing diffuse lung disease. It is recommended when the initial evaluation of the dyspneic patient is nonrevealing or when it reveals abnormality but no definitive diagnosis. Expiratory HRCT is indicated in patients with obstructive physiology and suspected tracheobronchomalacia. Expiratory CT series can also be useful in the evaluation of interstitial lung disease.
- Contrast-enhanced CT is rarely indicated in the evaluation of chronic dyspnea.
- MRI and PET have a role in the evaluation of chest wall masses and pleural disease, but their roles in diffuse lung disease are still investigational.

Abbreviations

- CT, computed tomography
- CTA, computed tomography angiography
- FDG-PET, fluorine-18-2-fluoro-2-deoxy-D-glucose positron emission tomography
- MRI, magnetic resonance imaging
- PFTs, pulmonary function tests

Relative Radiation Level Designations

Relative Radiation Level*	Adult Effective Dose Estimate Range	Pediatric Effective Dose Estimate Range
O	0 mSv	0 mSv
	<0.1 mSv	<0.03 mSv
	0.1-1 mSv	0.03-0.3 mSv
	1-10 mSv	0.3-3 mSv
	10-30 mSv	3-10 mSv
	30-100 mSv	10-30 mSv
*RRL assignments for some of the examinations cannot be made, because the actual patient doses in these procedures vary as a function of a number of factors (e.g., region of the body exposed to ionizing radiation, the imaging guidance that is used). The RRLs for these examinations are designated as “Varies.”		

Clinical Algorithm(s)

Algorithms were not developed from criteria guidelines.

Scope

Disease/Condition(s)

Chronic dyspnea

Note: This document addresses chronic dyspnea of pulmonary origin, particularly chronic obstructive pulmonary disease and interstitial lung disease. Two important causes for acute dyspnea, pulmonary embolism and congestive heart failure, are not included in this section as they are reviewed in other American College of Radiology (ACR) Appropriateness Criteria® topics.

Guideline Category

Diagnosis

Evaluation

Clinical Specialty

Cardiology

Family Practice

Internal Medicine

Pulmonary Medicine

Radiology

Intended Users

Health Plans

Hospitals

Managed Care Organizations

Physicians

Utilization Management

Guideline Objective(s)

To evaluate the appropriateness of initial radiologic examinations for patients with chronic dyspnea

Target Population

Patients with chronic dyspnea

Interventions and Practices Considered

1. X-ray chest
2. Computed tomography (CT) chest
    - With contrast
    - Without contrast
    - Without and with contrast
3. Magnetic resonance imaging (MRI)
    - Without contrast
    - Without and with contrast
4. Fluorine-18-2-fluoro-2-deoxy-D-glucose positron emission tomography (FDG-PET)/CT

Major Outcomes Considered

Utility of radiologic examinations in differential diagnosis

Methodology

Methods Used to Collect/Select the Evidence

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

Literature Search Procedure

The Medline literature search is based on keywords provided by the topic author. The two general classes of keywords are those related to the condition (e.g., ankle pain, fever) and those that describe the diagnostic or therapeutic intervention of interest (e.g., mammography, MRI).

The search terms and parameters are manipulated to produce the most relevant, current evidence to address the American College of Radiology Appropriateness Criteria (ACR AC) topic being reviewed or developed. Combining the clinical conditions and diagnostic modalities or therapeutic procedures narrows the search to be relevant to the topic. Exploding the term "diagnostic imaging" captures relevant results for diagnostic topics.

The following criteria/limits are used in the searches.

1. Articles that have abstracts available and are concerned with humans.
2. Restrict the search to the year prior to the last topic update or in some cases the author of the topic may specify which year range to use in the search. For new topics, the year range is restricted to the last 5 years unless the topic author provides other instructions.
3. May restrict the search to Adults only or Pediatrics only.
4. Articles consisting of only summaries or case reports are often excluded from final results.

The search strategy may be revised to improve the output as needed.

Number of Source Documents

The total number of source documents identified as the result of the literature search is not known.

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

Strength of Evidence Key

Category 1 - The conclusions of the study are valid and strongly supported by study design, analysis, and results.

Category 2 - The conclusions of the study are likely valid, but study design does not permit certainty.

Category 3 - The conclusions of the study may be valid but the evidence supporting the conclusions is inconclusive or equivocal.

Category 4 - The conclusions of the study may not be valid because the evidence may not be reliable given the study design or analysis.

Methods Used to Analyze the Evidence

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

The topic author drafts or revises the narrative text summarizing the evidence found in the literature. American College of Radiology (ACR) staff draft an evidence table based on the analysis of the selected literature. These tables rate the strength of the evidence for all articles included in the narrative text.

The expert panel reviews the narrative text, evidence table, and the supporting literature for each of the topic-variant combinations and assigns an appropriateness rating for each procedure listed in the table. Each individual panel member forms his/her own opinion based on his/her interpretation of the available evidence.

More information about the evidence table development process can be found in the ACR Appropriateness Criteria® Evidence Table Development document (see the "Availability of Companion Documents" field).

Methods Used to Formulate the Recommendations

Expert Consensus (Delphi)

Description of Methods Used to Formulate the Recommendations

Modified Delphi Technique

The appropriateness ratings for each of the procedures included in the Appropriateness Criteria topics are determined using a modified Delphi methodology. A series of surveys are conducted to elicit each panelist's expert interpretation of the evidence, based on the available data, regarding the appropriateness of an imaging or therapeutic procedure for a specific clinical scenario. American College of Radiology (ACR) staff distributes surveys to the panelists along with the evidence table and narrative. Each panelist interprets the available evidence and rates each procedure. The surveys are completed by panelists without consulting other panelists. The ratings are a scale between 1 and 9, which is further divided into three categories: 1, 2, or 3 is defined as "usually not appropriate"; 4, 5, or 6 is defined as "may be appropriate"; and 7, 8, or 9 is defined as "usually appropriate." Each panel member assigns one rating for each procedure per survey round. The surveys are collected and the results are tabulated, de-identified and redistributed after each round. A maximum of three rounds are conducted. The modified Delphi technique enables each panelist to express individual interpretations of the evidence and his or her expert opinion without excessive bias from fellow panelists in a simple, standardized and economical process.

Consensus among the panel members must be achieved to determine the final rating for each procedure. Consensus is defined as eighty percent (80%) agreement within a rating category. The final rating is determined by the median of all the ratings once consensus has been reached. Up to three rating rounds are conducted to achieve consensus.

If consensus is not reached, the panel is convened by conference call. The strengths and weaknesses of each imaging procedure that has not reached consensus are discussed and a final rating is proposed. If the panelists on the call agree, the rating is accepted as the panel's consensus. The document is circulated to all the panelists to make the final determination. If consensus cannot be reached on the call or when the document is circulated, "No consensus" appears in the rating column and the reasons for this decision are added to the comment sections.

Rating Scheme for the Strength of the Recommendations

Not applicable

Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

Method of Guideline Validation

Internal Peer Review

Description of Method of Guideline Validation

Criteria developed by the Expert Panels are reviewed by the American College of Radiology (ACR) Committee on Appropriateness Criteria.

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The recommendations are based on analysis of the current literature and expert panel consensus.

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

Selection of appropriate radiologic imaging procedures for evaluation of patients with chronic dyspnea

Potential Harms

Relative Radiation Level (RRL)

Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level indication has been included for each imaging examination. The RRLs are based on effective dose, which is a radiation dose quantity that is used to estimate population total radiation risk associated with an imaging procedure. Patients in the pediatric age group are at inherently higher risk from exposure, both because of organ sensitivity and longer life expectancy (relevant to the long latency that appears to accompany radiation exposure). For these reasons, the RRL dose estimate ranges for pediatric examinations are lower as compared to those specified for adults. Additional information regarding radiation dose assessment for imaging examinations can be found in the American College of Radiology (ACR) Appropriateness Criteria® Radiation Dose Assessment Introduction document (see "Availability of Companion Documents" field).

Qualifying Statements

Qualifying Statements

The American College of Radiology (ACR) Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those examinations generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the U.S. Food and Drug Administration (FDA) have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Getting Better

Living with Illness

IOM Domain

Effectiveness

Identifying Information and Availability

Bibliographic Source(s)

Dyer DS, Mohammed TL, Kirsch J, Amorosa JK, Brown K, Chung JH, Ginsburg ME, Heitkamp DE, Kanne JP, Kazerooni EA, Ketai LH, Parker JA, Ravenel JG, Saleh AG, Shah RD, Expert Panel on Thoracic Imaging. ACR Appropriateness CriteriaÂ® chronic dyspnea - suspected pulmonary origin. [online publication]. Reston (VA): American College of Radiology (ACR); 2012. 5 p. [68 references]

Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

1995 (revised 2012)

Guideline Developer(s)

American College of Radiology - Medical Specialty Society

Source(s) of Funding

The American College of Radiology (ACR) provided the funding and the resources for these ACR Appropriateness Criteria®.

Guideline Committee

Committee on Appropriateness Criteria, Expert Panel on Thoracic Imaging

Composition of Group That Authored the Guideline

Panel Members: Debra Sue Dyer, MD (*Principal Author*); Tan-Lucien H. Mohammed, MD (*Panel Chair*); Jacobo Kirsch, MD (*Panel Vice-chair*); Judith K. Amorosa, MD; Kathleen Brown, MD; Jonathan H. Chung, MD; Mark E. Ginsburg, MD; Darel E. Heitkamp, MD; Jeffrey P. Kanne, MD; Ella A. Kazerooni, MD; Loren H. Ketai, MD; J. Anthony Parker, MD, PhD; James G. Ravenel, MD; Anthony G. Saleh, MD;

Rakesh D. Shah, MD

Financial Disclosures/Conflicts of Interest

Not stated

Guideline Status

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Guideline Availability

Electronic copies: Available from the American College of Radiology (ACR) Web site.

Print copies: Available from the American College of Radiology, 1891 Preston White Drive, Reston, VA 20191. Telephone: (703) 648-8900.

Availability of Companion Documents

The following are available:

- ACR Appropriateness Criteria®. Overview. Reston (VA): American College of Radiology; 2 p. Electronic copies: Available in Portable Document Format (PDF) from the American College of Radiology (ACR) Web site.
- ACR Appropriateness Criteria®. Literature search process. Reston (VA): American College of Radiology; 1 p. Electronic copies: Available in PDF from the ACR Web site.
- ACR Appropriateness Criteria®. Evidence table development – diagnostic studies. Reston (VA): American College of Radiology; 2013 Nov. 3 p. Electronic copies: Available in PDF from the ACR Web site.
- ACR Appropriateness Criteria®. Radiation dose assessment introduction. Reston (VA): American College of Radiology; 2 p. Electronic copies: Available in PDF from the ACR Web site.
- ACR Appropriateness Criteria®. Procedure information. Reston (VA): American College of Radiology; 1 p. Electronic copies: Available in PDF from the ACR Web site.
- ACR Appropriateness Criteria® chronic dyspnea — suspected pulmonary origin. Evidence table. Reston (VA): American College of Radiology; 2012. 20 p. Electronic copies: Available in PDF from the ACR Web site.

Patient Resources

None available

NGC Status

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